

Claims

What is claimed:

1. A stacked magnetic memory structure comprising:
 - a first group of magnetic tunnel junctions, the first group comprising:
 - a first group first layer, the first layer comprising a first plurality of magnetic tunnel junctions;
 - a first group second layer formed adjacent to the first layer, the second layer comprising a second plurality of magnetic tunnel junctions; and
 - a common first group conductor connected to each of the first plurality of magnetic tunnel junctions and the second plurality of magnetic tunnel junctions.
2. The stacked magnetic memory structure of claim 1, wherein the common first group conductor comprises resistive regions proximate to at least one of the first plurality of magnetic tunnel junctions and the second plurality of magnetic tunnel junctions.
3. The stacked magnetic memory structure of claim 1, wherein the common first group conductor comprises first heater regions proximate to at least one of the first plurality of magnetic tunnel junctions and the second plurality of magnetic tunnel junctions.
4. The stacked magnetic memory structure of claim 3, wherein the first heater regions thermally heat at least one of the first plurality of magnetic tunnel junctions and the second plurality of magnetic tunnel junctions when at least one of the first plurality of magnetic tunnel junctions and the second plurality of magnetic tunnel junctions is selected.
5. The stacked magnetic memory structure of claim 1, further comprising:
 - a second group of magnetic tunnel junctions, the second group comprising:
 - a second group first layer, the second group first layer comprising a third plurality of magnetic tunnel junctions;

a second group second layer formed adjacent to the second group first layer, the second group second layer comprising a fourth plurality of magnetic tunnel junctions; a common second group conductor connected to each of the third plurality of magnetic tunnel junctions and the fourth plurality of magnetic tunnel junctions.

6. The stacked magnetic memory structure of claim 5, wherein the common second group conductor comprises second heater regions proximate to each of the third plurality of magnetic tunnel junctions and the fourth plurality of magnetic tunnel junctions.
7. The stacked magnetic memory structure of claim 6, wherein the first heater regions are turned on if the first and second pluralities of magnetic tunnel junctions are selected, and the second heater regions are turned on if the third and fourth magnetic tunnel junctions are selected.
8. The stacked magnetic memory structure of claim 6, wherein heater regions of a group are turned on only when the group is selecting for writing.
9. The stacked magnetic memory structure of claim 5, wherein active devices that control selection of the magnetic tunnel junction are formed in the substrate.
10. The stacked magnetic memory structure of claim 5, wherein active devices that control sensing of magnetic states of the magnetic tunnel junction are formed in the substrate.
11. The stacked magnetic memory structure of claim 6, wherein less write current is required to write to a selected group of magnetic tunnel junctions.
12. The stacked magnetic memory structure of claim 6, wherein less write current is required to write to the first, second, third and fourth magnetic tunnel junctions if a corresponding heater regions are turned on.

13. The stacked magnetic memory structure of claim 1, further comprising first select lines, second select lines and third select lines, the first select lines selecting individual magnetic tunnel junctions, the second select lines and third select lines selecting the first and second pluralities of magnetic tunnel junctions.
14. The stacked magnetic memory structure of claim 13, wherein a first select line, a second select line and a third select line must be selected to write to a magnetic tunnel junction.
15. The stacked magnetic memory structure of claim 13, wherein only a first select line and a second select line must be selected to read from a magnetic tunnel junction.
16. The stacked magnetic memory structure of claim 13, wherein the first select lines are column select lines, the second select lines are row enable lines and the third select lines are write enable lines.
17. The stacked magnetic memory structure of claim 1, wherein the first group first layer and the first group second layer are formed above and below the common first group conductor.
18. The stacked magnetic memory structure of claim 3, wherein current conducted through the common first group conductor causes the first heater regions to heat, and generates a write magnetic field.
19. A stacked magnetic memory structure comprising:
 - a first group of magnetic tunnel junctions, the first group comprising:
 - a first group first layer formed adjacent to a substrate, the first layer comprising a first plurality of magnetic tunnel junctions;
 - a first group second layer formed adjacent to the first layer, the second layer comprising a second plurality of magnetic tunnel junctions;

a first heater formed adjacent to at least one of the first plurality of magnetic tunnel junctions and the second plurality of magnetic tunnel junctions, the first heater providing thermal heat to the at least one of the first plurality of magnetic tunnel junctions and the second plurality of magnetic tunnel junctions.

20. The stacked magnetic memory structure of claim 19, further comprising:

a second heater formed adjacent to an other of the first plurality of magnetic tunnel junctions and the second plurality of magnetic tunnel junctions, the second heater providing thermal heat to the other of the first plurality of magnetic tunnel junctions and the second plurality of magnetic tunnel junctions.

21. The stacked magnetic memory structure of claim 19, further comprising:

a second group of magnetic tunnel junctions, the second group comprising:

a second group first layer formed adjacent to the substrate, the second group first comprising a third plurality of magnetic tunnel junctions;

a second group second layer formed adjacent to the second group first layer, the second group second layer comprising a fourth plurality of magnetic tunnel junctions;

a third heater formed adjacent to at least one of the third plurality of magnetic tunnel junctions and the fourth plurality of magnetic tunnel junctions, the third heater providing thermal heat to the at least one of the third plurality of magnetic tunnel junctions and the fourth plurality of magnetic tunnel junctions.

22. The stacked magnetic memory structure of claim 21, wherein the first heater is turned on if the first and second pluralities of magnetic tunnel junctions are selected, and the third heater is turned on if the third and fourth magnetic tunnel junctions are selected.

23. The stacked magnetic memory structure of claim 21, wherein a heater of a group is turned on only when the group is selecting for writing.

24. The stacked magnetic memory structure of claim 21, wherein active devices that control selection of the magnetic tunnel junction are formed in the substrate.
25. The stacked magnetic memory structure of claim 21, wherein active devices that control sensing of magnetic states of the magnetic tunnel junction are formed in the substrate.
26. The stacked magnetic memory structure of claim 21, wherein less write current is required to write to a selected group of magnetic tunnel junctions.
27. The stacked magnetic memory structure of claim 21, wherein less write current is required to write to the first, second, third and fourth magnetic tunnel junctions if a corresponding heater is turned on.
28. The stacked magnetic memory structure of claim 19, further comprising first select lines, second select lines and third select lines, the first select lines selecting individual magnetic tunnel junctions, the second select lines and third select line selecting the first and second pluralities of magnetic tunnel junctions.
29. The stacked magnetic memory structure of claim 28, wherein a first select line, a second select line and a third select line must be selected to write to a magnetic tunnel junction.
30. The stacked magnetic memory structure of claim 28, wherein only a first select line and a second select line must be selected to read from a magnetic tunnel junction.
31. The stacked magnetic memory structure of claim 28, wherein the first select lines are column select lines, the second select lines are row enable lines and the third select lines are write enable lines.
32. The stacked magnetic memory structure of claim 21, wherein the third heater is formed from at least one of tungsten and platinum.

33. A computing system comprising:

- a central processing unit;
- a memory array electronically connected to the central processing unit;
- the memory array comprising a stacked magnetic memory structure;
 - the stacked magnetic memory structure comprising:
 - a first group of magnetic tunnel junctions, the first group comprising:
 - a first layer formed adjacent to a substrate, the first layer comprising a first plurality of magnetic tunnel junctions;
 - a second layer formed adjacent to the first layer, the second layer comprising a second plurality of magnetic tunnel junction;
 - a first heater formed adjacent to at least one of the first plurality of magnetic tunnel junctions and the second plurality of magnetic tunnel junctions, the first heater providing thermal heat to the at least one of the first plurality of magnetic tunnel junctions and the second plurality of magnetic tunnel junctions.

34. The computing system of claim 33, further comprising:

- a second group of magnetic tunnel junctions, the second group comprising:
 - a second group first formed adjacent to the substrate, the second group first comprising a third plurality of magnetic tunnel junctions;
 - a second group second layer formed adjacent to the second group first, the second group second layer comprising a fourth plurality of magnetic tunnel junction;
 - a third heater formed adjacent to at least one of the third plurality of magnetic tunnel junctions and the fourth plurality of magnetic tunnel junctions, the third heater providing thermal heat to the at least one of the third plurality of magnetic tunnel junctions and the fourth plurality of magnetic tunnel junctions;
- wherein only one of the first group and second group can be selected at a time.

35. A method of writing to a stacked magnetic memory structure, the stacked magnetic memory structure comprising a first layer formed adjacent to a substrate, the first layer comprising a first plurality of magnetic tunnel junctions, a second layer formed adjacent to the first layer, the second layer comprising a second plurality of magnetic tunnel junction, a first heater formed adjacent to at least one of the first plurality of magnetic tunnel junctions and the second plurality of magnetic tunnel junctions, the first heater providing thermal heat to the at least one of the first plurality of magnetic tunnel junctions and the second plurality of magnetic tunnel junctions, the method comprising:

selecting at least one column select line;

selecting at least one row enable line;

selecting a write enable line that turns on a corresponding heater.

36. A method of reading a stacked magnetic memory structure, the stacked magnetic memory structure comprising a first layer formed adjacent to a substrate, the first layer comprising a first plurality of magnetic tunnel junctions, a second layer formed adjacent to the first layer, the second layer comprising a second plurality of magnetic tunnel junction, a first heater formed adjacent to at least one of the first plurality of magnetic tunnel junctions and the second plurality of magnetic tunnel junctions, the first heater providing thermal heat to the at least one of the first plurality of magnetic tunnel junctions and the second plurality of magnetic tunnel junctions, the method comprising:

selecting at least one column select line;

selecting at least one row enable line;

sensing a resistive state of a corresponding magnetic tunnel junction.